Water Producer Project in the Pipiripau River Basin, Federal District - DF, Brazil

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ABSTRACT

This paper discuss the Project "Water Producer in the Pipiripau River Basin, Federal District, Brazil", which aims to improve the management of soil and water in that river basin. Used methodology consisted of consulting the official documents resulting from field work carried out by the Project managers and partners. It brings up an important result on the application of techniques of soil conservation, plant cover replacement and monitoring of water quality and quantity. Also, discuss environmental benefits of the Project, the importance of Payment for Environmental Services (PES) and implemented actions to improve water production in rural area.

1.INTRODUCTION

The purpose of this work is: (a) to discuss the results of the Water Producer Project in the Pipiripau River Basin, Federal District - DF, Brazil *("Produtor de Água no Pipiripau, DF" in portuguese);* (b) to analyze the social economic benefits for the project participants; (c) to discuss in what extent the Payment for Environmental Services (PES), a voluntary adoption of environmental-friendly practices by rural producers, can be used as an instrument to improve water and soil management, springs restoration, and to increase water supply for urban and rural areas in the Pipiripau River Basin, DF, Brazil and (d) to discuss importance of Payment for Environmental Services as determinant instrument for resolution of conflict characterized by downstream externality production (water cooperation) as it contributes to the (re)establishment of trust and dialogue.

In others words, this study intends to raise doubts on three questions. Water Producer Project in the Pipiripau River Basin, DF, Brazil: (1) generates social, economical and environmental benefits relevant to value chain involved to improve water quality and quantity and soil management? (2) Payments for Environmental Services (PES) stimulate a rural producer to avoid management mistakes and to preserve ecosystems that are still intact? (3) Rural producers that adopt the project have declared relatively satisfied with the results and would like to renew contracts to its end?

Environmental services means the maintenance of ecosystem services, that is, the capacity of ecosystems to maintain environmental conditions suitable for life on Earth, that depends on the implementation of human practices that minimize adverse impacts in these biomes. One of the most common environmental services includes the planting of native trees, the enclosure of a forest fragment, preservation of biodiversity and water protection.

Water Producer Project differs from other rural projects in Brazil, since adopts the Payments for Environmental Services (PES). It is an innovative policy initiative of the Brazilian National Water Agency (in portuguese - Agência Nacional de Águas - ANA) with the objective of transferring monetary or non-monetary resources, for those that help conserve or produce such services through the adoption of sustainable agricultural practices.

Historically, the Pipiripau River Project, initiated with the signing of the technical cooperation agreement 002/2008 between Brazilian Agency for Water (ANA) and Regulatory Agency for Water, Energy and Sanitation of Federal District, Brazil (ADASA). The first Brazilian National Law relating to PES scheme is the *9.433/1997,* introducing the National Policy for Water Resources, which permitted monetary compensation for the implementation of conservation.

Payment for Environmental Services (PES) is also used to encourage the preservation of natural resources or the use of these in a sustainable manner. Involve the transfer of resources, financial or otherwise, for providers of environmental services in order to create or maintain the provision of these.

In other words, the PES consists in remuneration of owners of land rather than opt for overthrow of areas of forest to make room for commercial activities, theoretically more profitable, prevent deforestation and adopt technologies to enable better management of soil, recover deforested areas and make the preservation of these areas something more financially attractive than his exploration.

The total cost of deploying a PES is composed of the value transferred as payment and transaction costs related to the implementation and maintenance of the scheme. In the case of water producer program, the costs of their projects can be divided into 3 classes: 1) costs for forest recovery; 2) costs of soil conservation works and readjustment of rural roads; 3) costs related to payment for environmental services provided during the project.

With a view to implementing these goals occurred, in 2008, the first meetings on the topic to define what would be the area most appropriate for deploying the Federal District Water Producer Project. Due to features such as: optimum size, environmental degradation, large number of available information and high degree of conflict by the use of water resources in urban and rural areas, Pipiripau River Basin was chosen. The definition of this basin had the approval of the Brazilian National Water Agency (ANA), the Federal District Regulatory Agency for Water, Energy and Sanitation (ADASA) and the Federal District Environmental Sanitation Company (CAESB).

After the option of ANA by the Pipiripau River Basin, one of the first targets in order to achieve the objectives of this project was the elaboration of Socio-Environmental Diagnosis of this basin (Ana *et al*., 2010). The main purpose of this document was to gather the necessary grants for the activities of planning, definition of tasks and execution of actions under the Project. It was a very useful document to characterize study area in the present work.

Pipiripau Project has the general coordination of the Federal District Regulatory Agency for Water, Energy and Sanitation, Brazil (ADASA) and develops through seven working groups (WGs). Implementing the Pipiripau Project has involved partnerships of several governmental or non-governmental institutions that participate in the works, with human and material resources from your everyday activities without the need to book specific budgets for the project.

2.METHODOLOGY

Methodology consisted of an evaluation of field work carried out by the managers and partners of the Project, as well as, an extensive literature review of official publications, thesis and other documents. It includes a combination of interviews of identified stakeholders, including governmental institutions; field research; analyses of evaluation reports and of questionnaires applied to project participants in order to know their perception about the Project. Some field works were necessary to confirm secondary data.

Main consulted documents used to prepare this paper were ADASA (2012); ANA (2003); ANA *et al* (2010); CAESB (2000 and 2001); Camelo (2011); Chaves (2003 a,b); De Albuquerque (2009); Ganen (2015) Gonçalves (2012); Melo (2013); Oliveira (2006); Oliveira e Wehrmann (2005); Pereira (2013); Silva (2010 and 2014).

3.STUDY AREA

The Pipiripau River is located in the Federal District, in the central part of Brazil and drains south toward the Paraná River Basin. It has 122 km of water courses, and the total length of its main bed is 41km from the source to the mouth. It occupies a total area of 23,527 hectares.

The relief of the basin is predominantly flat to slightly wavy. In the region can be found seven categories of soils, with a predominance of Latosol. The period of greatest rainfall runs from October to March, when occurs approximately 85% of the total annual precipitation. The month of greatest rainfall is January and the least rainy is July.

According to ANA *et al*., 2010, regarding the use and land coverage: extensive agriculture land occupies 10,181.1 ha (43.3%); the pastures 5,050 ha (21.5%) irrigated culture 1,554.6 (6.6%). The natural vegetation is Brazilian Cerrado Biome, including different types of vegetations: Cerrado with 2,513.1 ha (10.7%); gallery forest 980.1 (4.2%); grass fields 834.2 (3.5%) and the altered vegetation 1,544.6 (6.6%). The basin shelter two conservation units areas: the Reserve of Pequi and Pipiripau Falls Experimental Park.

The other land covers include altered environments such as urban areas, farmer houses and buildings, paved roads or not, reforestation, soil exposed and water courses

Stands out in the Pipiripau River Basin, the Santos Dumont Rural Nucleus made up by 84 rural lots with average area of 07 hectares each, used mainly to plant vegetables that depends on irrigation in the period from March to October. In the

Santos Dumont Rural Nucleus live approximately 440 people. The Nucleus produces 336 tons of vegetables per year, and can generate 800 to 1000 direct jobs.

In 1984, was built on Santos Dumont Rural Nucleus, the channel of Santos Dumont, in order to irrigate and enable the agricultural production with water intake in the Pipiripau River. The granting of the channel is of 350 L/sec, and each property has a grant of 4 L/sec. A study in 2015 by the project through its partners revealed there's loss of approximately 200 L/sec, which represents the losses due to infiltration of the channel, infiltration and evaporation in reservoirs and in irrigation systems.

The Santos Dumont Channel operations began in 1989. The water outlet is made in the Pipiripau River and reaches the rural properties of this community by gravity. Consists of a main channel with 9,800 meters (1,900 m concrete coated and 7,900 m uncoated) and 8 secondary channels (8,790 m without coating) (Figure 01). Several conflicts by the use of water have been consistently observed in the basin since the beginning of its occupation.

Figure 01. Partial view of Santos Dumont Channel (ANA *et al.,* 2010).

The waters of Santos Dumont Channel are used through sprinkling in 56% of the units; furrow in 21% of the units; drip in 19% and micro sprinkler in 4% of the units.

Two other consumers with relevant water use in the basin are a central pivot, the only one in the basin, and a company of extraction and washing of sand. The last two mentioned are located next to the headboard and extract, respectively, 43.91 and 23.61 L/sec of water.

In summary, Pipiripau River Basin concentrates various activities of economic interest, such as production of fruits, grains, meats, leisure, environmental protection and human water supply catchment. Due to the rural characteristics of the region, the economically active population is involved in agriculture.

Table 01 shows the distribution of number and total areas of properties by size class in Pipiripau River Basin.

Table 01 Distribution of number and total areas of properties by size class in Pipiripau River basin.

Size class	Number (%) of properties by size class	Total area (%) of the property by size class
20 hectares	184 (44%)	1.981,55 hectares (8%)
20-93 hectares	196 (46%)	7.112,44 hectares (31%)
93-370 hectares	35 (8%)	6.274,84 hectares (27%)
370-1.588 hectares	9 (2%)	7.797,46 hectares (34%)

4.RESULTS AND DISCUSSION

Up until 2016, total invested and planned (to next 2 years) in Pipiripau River Project was estimated in approximately US$ 5,400,000 including: soil conservation (US$ 800,000); Recovery of Permanent Protection Area and Legal Reserves (US$ 1,730,000); Payment for Environmental Services (US$ 570,000) and increasement of Water, quality and quantity (US$ 2,300,000). The estimated total cost for the project is approximately US$ 12,500,000.

Following are presented the main results obtained in the surveys conducted in the framework of the project, developed by the Working Groups (WGs).

Work Group 1 (WG1), under responsibility of National Water Agency (ANA) is in charge of soil conservation and performed initially the mapping of areas sensitive to erosion. According to the experts who have contributed to the initial diagnosis (ANA *et al*., 2010), lost in the basin, annually, more than 2 million tons of soil per year caused by erosion, which in turn cause siltation of water bodies. To counter this prejudice to the areas of culture, the project already implemented 1,160 hectares of terraces (barriers to contain the speed of water in slope), in addition to the construction of "barraginhas" (little dams) and reform of roads.

One of the mechanical works aimed at soil conservation and the prevention of erosion, include: the construction of 985 transverse undulations; the construction and maintenance of 1,160 hectares of terraces; improvement of 61.25 km of 4 and 67,5 Km of 8 meters large roads of internal properties and the construction and maintenance of 545 water retention basins. Figure 02 shows an example of these works.

Figure 02. Soil recovery actions and service/maintenance of roads (terraces and detention basin). ANA *et al,* 2010.

Work Group 2 (WG2), under responsibility of the Federal District Agriculture Secretariat (SEAGRI) is in charge of **-** Recovery of Permanent Protection Areas (APP) and Legal Reserves.
This Group took care of the planting of seedlings of native species, and in 2012/2016 cycles, more than 300,000 seedlings were planted, involving a lot of logistics and infrastructure such as the construction of plant nurseries and greenhouses, buying supplies, cars and tools and hiring of personnel.

Figure 03 shows a greenhouse with seedlings ready to be planted and reclaimed area after three years has been reforested.

Figure 03. Seedlings ready for planting being irrigated in the greenhouse (left) and the first area native seedlings planted in Permanent Protection Area (APP) three years after.(right). ADASA (2015).

As a result of this production of seedlings of native plants and planting of these APP's recovery and Legal Reserve, with investments provided by the project was revitalized a public nursery in which were produced about 350,000 seedlings of native plants.

Work Group 3 (WG3), under responsibility of the Federal District Regulatory Agency for Water, Energy and Sanitation, Brazil, ADASA is in charge of Payment for Environmental Services (PES).

Until August 2016 had already been enrolled 130 producers and hired more than 110 of these, making a financial commitment of approximately US$ 500,000. In this line of work, there is no mention in scholarships, but in payment for environmental services effectively rendered. Therefore, the payment is only made after the environmental services are duly attested by an Evaluation Commission opinion.

The PES paid to the producer participant currently ranges from US$ 20.00 to US$ 80.00 per hectare depending on the applicable mode to the area. However, this value of PES represents only the effective resource that the producer wins for their participation. The producer receives two financial benefits, a direct and other indirect.

The Pipiripau Project had its first diagnosis in the period from 2009 to 2012, after the release of the notice for Payment for Environmental Services – PES of 2 contracts. In 2013 were registered 15 contracts and 2 payments and, in 2014, were 7 contracts and 17 Payments.

In 2015 were 44 contracts and 24 payments. In 2016 were 35 contracts and 68 payments. Early in the project there were 423 properties involved and nowadays, there were 591. From 2012 to 2016, 130 farmers have joined the project.

Work Group 4 (WG4), under responsibility of Federal District Environmental Sanitation Company (CAESB) is in charge of revitalization of the Santos Dumont Channel in the Pipiripau River Basin.

In this Group, several partners are acting for the revitalization of this channel. According to the preliminary studies water losses that have occurred since the construction of the channel represented around 50% of the volume picked up. After the studies it was demonstrated (and it was agreed) that each property needs to receive a maximum of 2.5 L/sec and that would set a better technique for the revitalization of the channel. In this regard, it was proposed the full pipe and channel enhanced.

In 2002, the flow rate granted to the channel through the construction of a capture reinforcement on Capão Grande stream earmarked a further flow of 30 to 50 L/sec for the Santos Dumont Channel (Figure 04).

Figure 04. Flow rate of reinforcement for the Santos Dumont Channel. CAESB, 2009.

Work Group 5 (WG5), under responsability of the University of Brasilia, is in charge of monitoring of hydro-environmental data in the Pipiripau River Basin.

Monitoring results show that the waters of the Pipiripau River are of good quality, not getting sewers, but there's a lot of erosion of the banks causing the silting up of the River, due to the natural vulnerability to erosion.

Work Group 6 (WG6) under responsibility of the Federal District Environmental Institute is in charge of Environmental Education Actions. Until 2016 two actions were implemented, with about 800 students. In planning for the period 2017-2018 are provided for more activities involving new students, including an Environmental Education Program for rural producers, in addition to the creation of a Water Producer Project for children.

Work Group 7 (WG7) – communication and marketing - is in charge of organizing all the progress information for disclosure using different media. This group is

organizing a bilingual book about the project, which will be presented at the 8th World Water Forum to be held in Brasilia, Brazil, in March, 2018.

In synthesis, results obtained and discussed in this paper include: mechanical works aimed at soil conservation and roads erosion prevention in over 100 miles of extension; construction of 1,160 hectares of terraces, covering of the soil by over 300,000 seedlings of native species; contracting of more than 110 producers for the Payment for Environmental Services (PES).

This is the first experience in the Federal District, Brazil to encourage protection of sources – through the reforestation of Areas of Permanent Protection and Legal Reserves, construction of rural roads and soil and water conservation in productive areas, such as crops and pastures, with direct benefit to the Brazilian Federal District population.

The Pipiripau River Project, through the realization of coordinated actions by their 18 partners, collaborating to improve management comes from soil and water in this river basin, with a view to increasing the availability of water through the application of techniques of soil conservation, vegetation cover replacement in Permanent Preservation Areas and Legal Reserve.

In contrast with the prospect of a conventional water resources management and compartmentalized, the growing uncertainty about the body of water of the River Pipiripau and the introduction of new incentives to protect it by gradually encouraged Pipiripau River Basin stakeholders to adopt a more holistic, coordinated, inclusive and interactive combination of strategies for the development and preservation of this basin. In fact, farmers who have adopted management and practices recommended by the Project for their properties, are living up to receive payment for environmental services provided.

According to Willemart (2016) “Payment for Ecosystem Service PES, can be considered as determinant instrument for resolution of conflict characterized by downstream externality production (water cooperation) as it contributes to the (re)establishment of trust and dialogue. Data collected from interviews relates that the payment has largely contributed in the decision of many producers to adopt a cooperative stance within the territory. PES as such is, however, insufficient to explain cooperative behavior (in environmental conflict) as many agents consider it as secondary to other: environmental awareness, family considerations, collective identification and product positioning. If certain manifested a certain disdain/contempt towards the payment, it is considered essential in the strategy to acquire agricultural inputs without prejudice to livelihood”.

The results showed that the PES is not considered a economic benefit so relevant for the producer, such as a purse or a source of extra income, regardless of whether the producer lives exclusively on earth or not. Is perceived more as an important incentive for conservation and as a recognition on the part of managers and society by the importance of his work on the preservation of natural resources. Nevertheless, the quantitative data show that 66% of participants responded that the economic benefits of the project are good or very good.

5.CONCLUSIONS AND FINAL CONSIDERATIONS

In conclusion, we can say that Water Producer Project in the Pipiripau River Basin, Federal District, Brazil, generates social, economical and environmental benefits relevant to value chain involved, to improve water quality and quantity and soil management and that there is no doubt that Payments for Environmental Services (PES) stimulate a rural producer to avoid management mistakes and to preserve ecosystems that are still intact.

An important positive point identified in the Pipiripau Project is that all of the producers interviewed who have adopted the methods of the project are relatively satisfied and would like to renew contracts to its end.

The Pipiripau Project has been a model for Brazil and also in other countries, on the basis of their achievements, especially by the great network of partners of governmental institutions, NGOs and third sector (Social Service). The participation and engagement of rural producers have been instrumental and contribute greatly to the achievement of project objectives to increase the quality and quantity of water and soil conservation.

Finally we can say that the project Water Producer in the Pipiripau River Basin reached so far most of their goals and that they should be made more investments to its greater efficiency.

One of the ways to further improve the Pipiripau River Project design include: encouraging communication between managers and participants; the improvement in planting; the promotion of the project; the creation of any new economic attractions, such as credit lines, increases or adjustments of PES, and activities for families including visits between them for better understanding of the design and implementation of environmental education programs.

The project has been working and will continue focusing its actions on improving health of the basin, providing higher quality and quantity of water, acting so effectively in the management of water resources, with the aim of achieving the following objectives, already provided for by the general coordination, in the near future:

From the results obtained it is suggested for the actions of the Work Groups(WGs) that new notices are prepared with proposals for actions in order to simplify and streamline processes to encourage the accession of new farmers. They are: keep the removal of taxes and of the contract; improve the functioning of the project flowchart; review the amounts paid by PES; deploy annual adjustment mechanisms due to inflationary losses during the 5-year contract.

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